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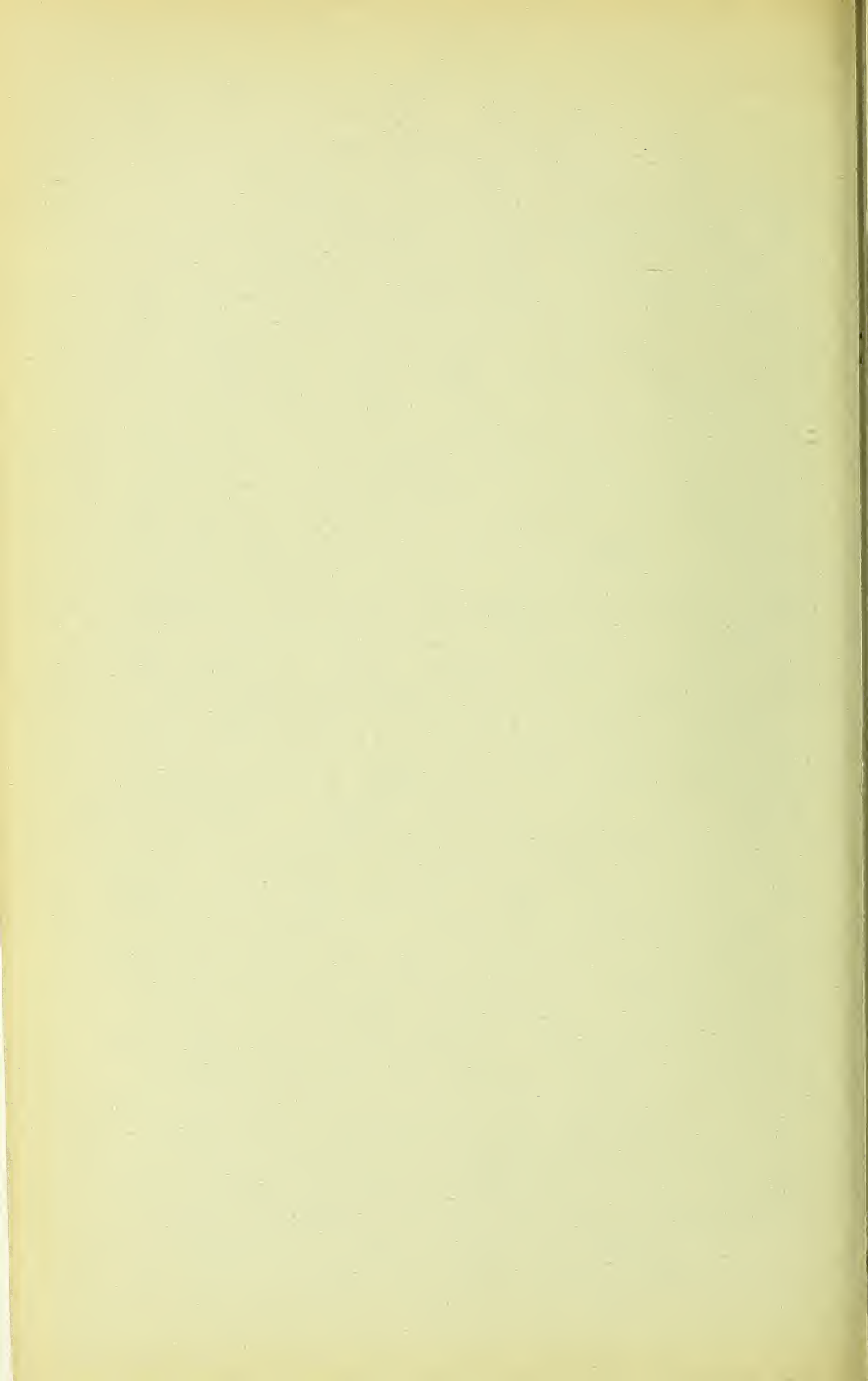
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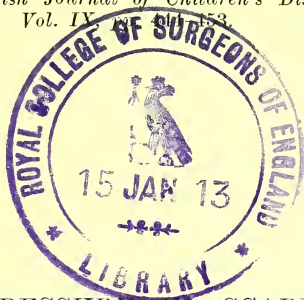
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**THE BLOOD-PRESSURE IN SCARLET FEVER.**

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## THE BLOOD-PRESSURE IN SCARLET FEVER.

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*Historical note.*—It is only within the last ten years that systematic observations on the blood-pressure in scarlet fever have been made with the sphygmomanometer, though the tension in post-scarlatinal nephritis had been examined with the sphygmograph at a much earlier date by Galabin (1873), Mahomed (1874), Gresswell (1884), and Riegel (1884).

Neu (1902) found that the blood-pressure sank during the febrile period and rose again in convalescence. Kolossova (1902), on the other hand, found that a rise occurred during the eruptive period, followed by a fall. Slatkow (1904) came to the same conclusion. Tscherepnin (1904) found that the highest blood-pressure was met with in the eruptive stage, and that the tension fell parallel with the fever. In the third and fourth weeks a fresh maximum pressure might be observed, concurrently with the onset of nephritis, the blood-pressure falling again as the nephritis cleared up.

The above four observers all made use of Gärtner's tonometer.

Federn (1903) with von Basch's instrument found that in scarlet fever, as he had also observed in cholera and malaria, the pressure was abnormally raised, and that the severer the infection the higher was the pressure. He admitted, however, that further observations were required to confirm his work. These, it may be remarked, have not been made. In convalescence he found the blood-pressure returned to normal. Injection of Moser's serum was followed by an immediate fall, though no such result attended the injection of ordinary horse serum.

Weigert (1907) used Riva-Rocci's instrument in 64 cases, employing the broad armlet in 5 cases and the narrow armlet in 59 cases. He found that scarlet fever following a normal course had hardly any effect on the blood-pressure. At most the readings were 10 mm. higher in late convalescence than during the febrile stage

and the first weeks of convalescence. The lowest record was frequently obtained in the first few days after the temperature had become normal, or in cases of protracted pyrexia in the last few days of the febrile period. Cardiac disturbance was occasionally accompanied by a moderate rise of pressure. Abnormally high readings were recorded in a fatal case of acute nephritis (*vide infra*).

Nobécourt and Tixier (1908) used Potain's instrument in 33 patients of both sexes whose ages ranged from two to sixteen years. They found that as a rule the pressure sank from the beginning of the disease until the sixteenth day, but less frequently it remained stationary, and that in a few it rose. After the sixteenth day it usually rose again, but in a few cases it remained stationary. Change of diet, the character of the attack, and the occurrence of complications had no appreciable influence on the blood-pressure.

Teissier and Tanon (1908) examined 73 cases in adults between nineteen and twenty-five years of age with Potain's instrument; 38 were males, 35 females. They found that the blood-pressure was more liable to sink in the scarlet fever of the adult than in that of the child. The fall was early, and might even be present in the pre-eruptive stage. As in children, the pressure did not appear to be influenced by the character of the diet, nor, with the exception of nephritis with massive albuminuria, in which the tension rose, were complications associated with a rise of pressure. In mild cases the fall of pressure bore no relation to the temperature nor to the pulse frequency. In severe cases in which there was considerable hypotension the extent of the fall was related to the degree of pyrexia and tachycardia. Return of the pressure to the normal might be early or late, slow or rapid.

Since the appearance of Teisser and Tanon's paper no series of observations on the blood-pressure in scarlet fever has been published, but a few writers have drawn attention to the marked hypotension likely to occur in severe forms of the disease, and have referred this symptom to acute suprarenal insufficiency on account of the concomitant symptoms and post-mortem findings (Sergent, Hutinel, Comby, Ribadeau-Dumas and P. Harvier).

Hutinel, Grysez and Dupuich have recorded cases where the administration of adrenalin has been followed by rapid rise of blood-pressure and disappearance of the other symptoms of suprarenal involvement. Pospischill, on the other hand, who, like myself, had found adrenalin of great value in diphtheria, has observed no benefit from its use in scarlet fever.

The present paper is based on observations made on 122 cases of

scarlet fever with C. J. Martin's modification of Riva-Rocci's sphygmomanometer. As in my recent study of the blood-pressure in diphtheria, the systolic pressure as measured by the disappearance of the radial pulse was alone taken into consideration. The measurements, as far as possible, were taken at the same time each day between 2 and 3 p.m., *i. e.* from one and a half to two hours after food.

*Age and sex.*—Table I shows that the great majority of the patients were children: 79 were males, 43 females. As in diphtheria, there was no appreciable difference in the blood-pressure of any two individuals of different sexes, but of the same ages and suffering from attacks of equal severity.

TABLE I.

| Years.          | Males. | Females. |
|-----------------|--------|----------|
| 2-3 . . . . .   | 0      | 1        |
| 3-4 . . . . .   | 1      | 1        |
| 4-5 . . . . .   | 5      | 3        |
| 5-6 . . . . .   | 3      | 2        |
| 6-7 . . . . .   | 9      | 6        |
| 7-8 . . . . .   | 9      | 3        |
| 8-9 . . . . .   | 6      | 7        |
| 9-10 . . . . .  | 7      | 5        |
| 10-11 . . . . . | 6      | 6        |
| 11-12 . . . . . | 5      | 0        |
| 12-13 . . . . . | 6      | 3        |
| 13-14 . . . . . | 2      | 2        |
| 14-15 . . . . . | 3      | 0        |
| 15-34 . . . . . | 17     | 4        |
|                 | —      | —        |
|                 | 79     | 43       |

*Classification of cases.*—In 30 cases the blood-pressure was taken in convalescence only during the occurrence of nephritis. The remaining 92 were classified according to the character of the initial attack into severe (14 cases), moderate (26 cases), and mild (52 cases).

*The blood-pressure in scarlet fever.*—As judged by the standard of Cook and Briggs, according to which the blood-pressure of children up to two years is 75-90 mm. Hg., of older children 90-110 mm. and of young adults 130 mm., 23 of the 92 cases, or



25.0 per cent., showed from varying periods a pressure below the normal. The fall was most frequent and marked in the severe cases, among whom it occurred in 9 out of 14 cases, or 64 per cent.; in the moderate it was noticed in 7, or 26.3 per cent., and in the mild in 10, or 19.3 per cent.

Not only was the actual percentage of cases in this series showing a fall of blood-pressure decidedly less than that among my 179 cases of diphtheria, in whom it was 35.1, but the degree and duration of the fall were always much less marked. Thus in only 7 did the fall below normal exceed 10 mm., ranging in these cases from 12–30 mm., and in only 7 did it exceed a week, the duration in these cases being from 8 to 12 days. None showed a persistent rise above the normal standard of blood-pressure. In the acute stages, however, supra-normal readings were recorded in 16 cases.

On adopting Nobécourt and Tixier's plan of comparing the maximum pressure recorded during the first four days of the disease with the maximum pressure from the thirtieth to the fortieth days, when the patient could be regarded as normal, the following results were obtained: In 15 the blood-pressure was higher in convalescence than in the acute stage, in 37 it was lower, and in 25 it was the same at both periods.

From this it will be seen that in the majority of cases any change in the blood-pressure in scarlet fever was in a downward direction, in accordance with the general rule that febrile diseases tend to lower the blood-pressure.

*Date of highest and lowest blood-pressure.*—The following tables show the dates at which the highest and lowest blood-pressures were recorded. In the great majority the highest readings were obtained in the first week. There was also a preponderance of the lowest readings in the first week, though a large minority were found in the second week also.

TABLE II.—*Showing the Number of Cases in each Week in which the Highest Readings were Recorded.*

|                | 1st<br>week. | 2nd<br>week. | 3rd<br>week. | 4th<br>week. | 5th<br>week. | 6th<br>week. |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Severe . . .   | 11           | 1            | 0            | 1            | 0            | 1            |
| Moderate . . . | 17           | 1            | 4            | 2            | 2            | 0            |
| Mild . . .     | 39           | 4            | 6            | 3            | 0            | 0            |
|                | —            | —            | —            | —            | —            | —            |
|                | 67           | 6            | 10           | 6            | 2            | 1            |

TABLE III.—*Showing the Number of Cases in each Week in which the Lowest Readings were Recorded.*

|            | 1st<br>week. | 2nd<br>week. | 3rd<br>week. | 4th<br>week. | 5th<br>week. | 6th<br>week. | 7th<br>week. |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Severe .   | 6            | 6            | 0            | 1            | 0            | 1            | 0            |
| Moderate . | 13           | 11           | 1            | 0            | 0            | 0            | 1            |
| Mild .     | 25           | 22           | 4            | 0            | 1            | 0            | 0            |
|            | —            | —            | —            | —            | —            | —            | —            |
|            | 44           | 39           | 5            | 1            | 1            | 1            | 1            |

In 28 cases (4 severe, 9 moderate, 15 mild) the highest and lowest readings were both observed in the first week, the differences between the two ranging from 10 to 40 mm.

The preponderance of the highest readings in the first week is to be attributed, as in diphtheria, partly to the febrile disturbance and partly to the excitement caused by the application of an unfamiliar instrument. In support of the last explanation is the fact that among 82 cases admitted during the first week of the disease, in 59 the highest reading was the first taken. The difference between the highest and lowest records in a given case was naturally more marked in the severe than in the moderate, in the moderate than in mild cases. Thus among the severe cases the greatest difference was 60 mm., and the average 27 mm., among the moderate the greatest difference was 32 mm., and the average 16 mm., and among the mild the greatest difference was 32 mm., and the average 13 mm.

The highest reading apart from nephritis occurred in a girl, aged 15 years, convalescent from a severe attack, whose blood-pressure from the forty-ninth to the sixtieth days ranged between 130 and 150 mm. The lowest reading in a case which recovered was 70 mm., which was registered on three occasions in a girl, aged 6 years, convalescent from a mild attack. In none of the other cases which recovered did the blood-pressure fall below 80 mm.

TABLE IV.

|            | 1st<br>week. | 2nd<br>week. | 3rd<br>week. | 4th<br>week. | 5th<br>week. |
|------------|--------------|--------------|--------------|--------------|--------------|
| Severe .   | 1            | 1            | 0            | 0            | 1            |
| Moderate . | 0            | 3            | 1            | 2            | 1            |
| Mild .     | 0            | 1            | 4            | 3            | 0            |
|            | —            | —            | —            | —            | —            |
|            | 1            | 5            | 5            | 5            | 2            |

After deducting three fatal cases and two in which the blood-pressure never reached normal again during the period of observation, the date at which the pressure returned to normal according to Cook and Briggs' standard is shown in Table IV, from which it is seen that in the great majority the normal tension was regained by the fourth week.

*Relation of blood-pressure to pulse-rate.*—The highest pulse-rates were invariably found in the first week, and the lowest, as a rule, in the second and third weeks. The following table shows the exact figures in 85 cases :

TABLE V.—*Showing Weeks of Highest and Lowest Pulse-rates.*

|                    | Highest<br>pulse-rate. | Lowest pulse-rate. |              |              |  |
|--------------------|------------------------|--------------------|--------------|--------------|--|
|                    | 1st<br>week.           | 2nd<br>week.       | 3rd<br>week. | 4th<br>week. |  |
| Severe . . . . .   | 9                      | 2                  | 3            | 4            |  |
| Moderate . . . . . | 26                     | 9                  | 14           | 3            |  |
| Mild . . . . .     | 50                     | 38                 | 11           | 1            |  |
|                    | —                      | —                  | —            | —            |  |
|                    | 85                     | 49                 | 28           | 8            |  |

*Comparative readings in the erect and recumbent positions.*—The readings in the erect and recumbent positions in 95 patients in whom these comparative observations were made were as follows : In 25 the readings were the same, in 21 the reading was higher in the recumbent than in the erect position, and in 49 higher in the erect than in the recumbent position, when the patient was first allowed to get up. Thus in 46 cases, or 48·4 per cent., the reversal of the ordinary relations between the records in the two positions was found. This occurrence of the so-called hypotension of effort is liable to occur in convalescence from any acute disease, and has already been illustrated in my diphtheria cases, among whom it was still more frequent, occurring in 80 out of 103 cases, or 77·6 per cent.

In every case the normal relation was finally re-established before discharge from hospital.

*Effect of complications on blood-pressure.*—My own observations serve to confirm those made by Nobécourt and others (*vide supra*), to the effect that with the exception of nephritis complications have little or no effect on the blood-pressure in scarlet fever.

Thus among 11 cases of *rheumatism*, in 7 no change whatever was



noted, and in 4 there was a transient rise varying from 2 to 16 mm.

With the onset of *cervical adenitis* in convalescence, which occurred in 13 cases, in 8 there was no change, in 3 there was a rise of from 14 to 20 mm. and in 2 there was a fall of from 4 to 12 mm.

The occurrence of *otitis* in 7 cases was not accompanied by any change.

*Endocarditis*, which was noted in 2 cases, was associated with a slight rise in one case, and by none in the other.

*Laryngitis*, a terminal phenomenon in 2 cases, had a decidedly hypertensive action owing to the obstruction to respiration, the blood-pressure rising in two days in a girl, aged 9 years, from 90 to 120 mm. In the other case, a girl, aged 3 years, the blood-pressure rose in twenty-four hours from 90 to 110 mm.

Of 7 cases of *simple albuminuria* without other signs of nephritis 2 showed no rise, and 5 showed a rise ranging from 2 to 20 mm.

*Nephritis*.—Of 33 cases of nephritis only 12, the details of which are given in Table VI, showed any hypertension, and of these 3 had a supernormal reading only while the temperature was raised. Most of the twelve cases showed more or less marked oliguria and a relatively slow pulse.

TABLE VI.

| Age.    | Blood-pressure. | Pulse. | Ounces of urine in twenty-four hours. | Duration of hypertension. |
|---------|-----------------|--------|---------------------------------------|---------------------------|
| 4 years | 116             | 136    | 11-16                                 | 1 day.                    |
| 6 "     | 140-116         | 140    | 9-26                                  | 12 days.                  |
| 7 "     | 120             | 68     | 40-50                                 | 1 day.                    |
| 8 "     | 120             | 72     | 30                                    | 2 days.                   |
| 9 "     | 130-120         | 52     | 8-28                                  | 7 "                       |
| 9 "     | 150-120         | 144    | 35-37                                 | 3 "                       |
| 10 "    | 120             | 72     | 21                                    | 1 day.                    |
| 10 "    | 130-120         | 72     | 11-27                                 | 10 days.                  |
| 10 "    | 120             | 64     | 1-28                                  | 4 "                       |
| 10 "    | 126             | 72     | 20-45                                 | 7 "                       |
| 11 "    | 120             | 68     | 14                                    | 1 day.                    |
| 12 "    | 120             | 80     | 32                                    | 1 "                       |

In the remaining 21 patients, whose ages ranged from three to twelve years, the blood-pressure did not rise above 110 mm.

The absence of any rise of blood-pressure in many cases of post-

scarlatinal nephritis and the large number of cases in which only a slight rise was noted are in keeping with the fact that scarlatinal nephritis as a rule is a benign affection, the great majority of such cases—six sevenths according to Heubner's estimate—ending in complete recovery.

All my cases of nephritis recovered, and beyond drowsiness, occasional vomiting and headache, no symptoms suggestive of uræmia were observed. On this account no remarkably high readings were noted. Beyond some puffiness of the face none showed any degree of œdema. The fatal cases of scarlatinal nephritis as well as those with any considerable degree of œdema are usually cases in which the initial disease has been overlooked and the renal lesions have been neglected until irreparable damage has been done. Weigert relates such a case in a boy, aged 6 years, admitted to hospital with post-scarlatinal nephritis at the end of the third week. The blood-pressure on admission was 240 mm., and two days later 170 mm., a few hours before death. Hutinel also mentions a case with a pressure of 190 mm., accompanied by convulsive attacks which disappeared as the pressure fell.

My own observations thus concord more with those of Buttermann, Carter and Shaw, who in many cases of acute nephritis found no appreciable rise of pressure, than with those of Riegel, who stated that hypertension in scarlet fever was almost invariable.

It is of historical interest that Mahomed in 1873 distinguished a scarlatinal nephritis with a rise of arterial tension from scarlatinal nephritis without a rise, the former being due in his opinion to constipation and the latter to chill. His views, however, did not receive confirmation from subsequent writers. Astley Gresswell in his well-known monograph on scarlet fever contested this ætiology, and pointed out that it was impossible to distinguish these cases, rightly affirming that in scarlatinal nephritis there might be very marked tension or no more than occurs in health and almost every intermediate grade.

*Prognostic value of sphygmomanometry in scarlet fever.*—The early fatal cases showed a rapid fall of blood-pressure which was even more marked than in diphtheria, but it cannot be said that the use of the sphygmomanometer in the acute stage of scarlet fever any more than in that of any other acute disease with the exception of pneumonia affords information that is not given by the ordinary methods of examination. From a practical point of view its value is greater in the examination of cases of post-scarlatinal nephritis in which, *ceteris paribus*, a higher reading indicates a greater damage to the

kidney. The preservation of such records would be specially valuable to the family practitioner who has charge of the same individual during a number of years in enabling him to estimate the extent of the renal lesion and to direct his manner of life accordingly.

*Adrenalin therapy in scarlet fever.*—Hypotension being neither so frequent nor as a rule so marked as in diphtheria, the exhibition of adrenalin is seldom required in scarlet fever. In the present cases the drug was not employed. In view, however, of the encouraging results already alluded to, obtained by Hutinel and others, it is indicated in cases showing symptoms of acute suprarenal insufficiency. In many cases the suprarenal lesions are doubtless slight and transitory, but in a case of malignant scarlatina recorded by Comby in which the symptoms were repeated vomiting, diffuse abdominal pain, fœtid diarrhœa, and arterial hypotension, the necropsy showed complete destruction of the suprarenals by hæmorrhage. In such a case opotherapy, like any other treatment, is unavailing, but as the diagnosis of suprarenal hæmorrhage in the course of infectious disease cannot be made with certainty during life, signs of suprarenal invôlvement, especially pronounced hypotension, should be met by the administration of adrenalin or suprarenal extract.

#### SUMMARY.

(1) In a series of cases of scarlet fever the blood-pressure was found to be subnormal in 25 per cent., the extent and duration of the depression being as a rule in direct relation to the severity of the initial attack.

(2) In the great majority the highest readings were found in the first week; there was also a predominance of the lowest readings in the same week, but in a large minority the lowest readings were found in the second week. The normal tension was usually re-established by the fourth week.

(3) In the majority of cases the blood-pressure was lower in convalescence than in the acute stage.

(4) In 48·4 per cent. of the convalescent cases the readings in the recumbent and erect positions were the same, or the recumbent was higher than the vertical record until convalescence was firmly established (hypotension of effort).

(5) With the exception of nephritis complications had little, if any, effect upon the blood-pressure.

(6) In only a minority of the nephritis cases—12 out of 33—was

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the blood-pressure above normal, and the hypertension was never extreme nor of long duration.

(7) Sphygmomanometry in scarlet fever, as in most of the other acute diseases, is of little practical importance in the acute stage, but in convalescence may give some indication of the severity of the renal lesion which may be of value in subsequent treatment of the patient.

(8) Pronounced arterial hypotension, especially if accompanied by other signs of acute suprarenal insufficiency, should be treated by adrenalin or suprarenal extract.

### REFERENCES.

- (1) BUTTERMANN.—'Dent. Arch. f. klin. Med.,' 1902, lxxiv, p. 4.
- (2) CARTER, H. S.—'Amer. Journ. Med. Sci.,' 1901, cxxii, p. 854.
- (3) COMBY, J.—'Bull. et Mém. Soc. Méd. Hôp. de Paris.,' 1910, xxix, p. 689.
- (4) FEDERN, H.—'Wien. Klinik,' 1903, xxix, p. 259; 'Wien. klin. Woch.,' 1903, xvi, p. 608; 'Verhandl. des Kong. f. inn. Med.,' 1904, xxi, p. 576.
- (5) GALABIN, A. L.—'On the Connection of Bright's Disease with Changes in the Vascular System,' London, 1873.
- (6) GRESSWELL, D. A.—'Contribution to the Natural History of Scarlatina derived from Observations of the London Epidemic of 1887-1888,' Oxford, 1890.
- (7) GRYSEZ AND DUPUICH.—'Bull. et Mém. Soc. Méd. Hôp. de Paris.,' 1912, xxxiii, p. 61.
- (8) HUTINEL, V.—'Mal. des Enf.,' 1909, i, p. 356; 'Journ. des. Practic.,' 1909, xxiii, p. 146.
- (9) JANEWAY, T. C.—'Clinical Study of Blood-pressure,' London, 1904.
- (10) KOLOSSOVA.—Quoted by Weigert, *loc. cit.*
- (11) MAHOMED, F. A.—'Med.-Chir. Trans.,' 1874, lvii, p. 196.
- (12) NEU.—Quoted by Weigert, *loc. cit.*
- (13) NOBÉCOURT, P., AND TIXIER, L.—'Bull. Soc. Péd. de Paris,' 1908, x, p. 102, and 'Journ. de Physiol. et de Path. gén.,' 1908, x, p. 495.
- (14) POSPISCHILL, D., AND WEISS, S.—'Ueber Scharlach,' Berlin, 1911, p. 143.
- (15) RIBADEAU-DUMAS, L., and HARVIER, P.—'Bull. et Mém. Soc. Méd. Hôp. de Paris,' 1912, xxxiii, p. 28.
- (16) RIEGEL.—'Berlin. klin. Woch.,' 1882, xix, p. 345; 'Zeitschr. f. klin. Med.,' 1884, vii, p. 260.
- (17) ROLLESTON, J. D.—'BRITISH JOURNAL OF CHILDREN'S DISEASES,' 1911, viii, p. 433.
- (18) SERGENT, E.—'Journ. méd. franç.,' 1911, v, p. 471.
- (19) SHAW.—Quoted by Janeway, *loc. cit.*
- (20) SLATKOW.—Quoted by Weigert, *loc. cit.*
- (21) TEISSIER AND TANON.—'Journ. de Physiol. et de Path. gén.,' 1908, x, p. 481.
- (22) TSCHEREPNIN, S. N.—'St. Petersburg. med. Woch.,' 1904, xxix, Beilage, p. 54.
- (23) WEIGERT, K.—'Samml. klin. Vortr.,' No. 459 (Série xvi, Heft 9), Innere Med. No. 138.